The Sampler

PROTECTING NEW HAMPSHIRE'S LAKES THROUGH THE DEDICATION OF VOLUNTEERS

PUBLISHED BY THE NEW HAMPSHIRE DEPARTMENT OF ENVIRONMENTAL SERVICES
VOLUNTEER LAKE ASSESSMENT PROGRAM, SPRING 2004

Lake Association Steps to the Plate: Local Students Win in the End

by Alicia Carlson, DES Enviornmentalist

Is your lake association looking for ways to be more proactive in the community? Educating the local school students in lake stewardship may be a great match for your assocation and the local school. Here is a lesson to learn, compliments of the Lake Monomonac associations.

A Little About the Lake

Lake Monomonac extends from Rindge, New Hampshire, in the north to Winchendon, Massachusetts, in the south. There are two lake associations: the Monomonac Lake Property Owners' Association (MLPOA) based in New Hampshire, and the Winchendon Springs Lake Association based in Massachusetts. The two associations have tested the lake with VLAP since 1987.

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Teaching students how to use sampling equipment out on the lake. (DES File Photo)

Working with the Communities

In 1995, Dick Scotland, a respected volunteer monitor, brought the Interactive Lake Ecology Program (ILE) to the attention of the MLPOA's Board of Directors. DES had recently published the curriculum for middle school students, and Dick wanted to donate the workbooks to the local schools. He won the approval of the board and purchased enough ILE student workbooks to provide each fifth grader at the Rindge Memorial School with their own copy.

The MLPOA has since offered hundreds of students in Rindge and Winchendon's Toy Town Elementary the opportunity to study lakes in the classroom. Not only that, but the lake association also coordinates a visit to Lake Monomonac every June for all the students involved.

John Sarasin now takes the responsibility of purchasing the workbooks and coordinating the field trip to Lake Monomonac. John is a former director of the MLPOA. He typically begins organizing each year's activities in March. He identifies how many students will be participating and orders the ILE workbooks from DES. He later determines the date for the field trip and begins coordinating with volunteers and DES staff.

The Big Day

So, what exactly occurs on the day of the field trip? John has an efficient schedule for the field trip. He finds lake residents with pontoon boats who are willing to chauffeur the students onto the lake. In recent years, there has been as many as six pontoon boats. All parties involved meet at a private beach on the lake around nine a.m. and the day officially begins.

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Connor's Corner

by Jody Connor
DES Limnology Center
Director

Welcome to our 19th season of monitoring New Hampshire's lakes, ponds and watersheds. As always, I want to thank each of you for participating in the VLAP program; your dedication to monitoring and your commitment to protecting our lakes is a key to keeping our lakes within the top ten nationally in clarity. I want to stress again that the data you generate allows DES to assess the health of your waterbody and allows biologists to make important decisions on how best to protect lakes and manage watersheds.

DES Program Updates

The Biology Section continues to provide a focus on the lake's watershed. The watershed approach begins with monitoring the lake tributaries and identifying those tributaries that consistently provide sources of pollutants to the lake. Pollution sources are tracked by tributary bracketing sampling techniques. Some of you may notice that your VLAP report recommends additional sampling locations or storm event sampling. These recommendations help us locate problems so we are better prepared to design and implement best management practices to control the pollutant loading and protect the lake.

The Weed Watcher Program is also an important watershed management program. Volunteers are trained to identify common and exotic aquatic plants. The key to a volunteer Weed Watcher Program is early detection of an exotic plant before it has a chance to infest the lake. DES has achieved great success in controlling exotic infestations when these plants are detected early so that they do not have the chance to spread to other sections of the lake.

Another weapon used to fight the spread of exotic plants is the Lake Host Program. Approximately 150 trained people stand guard at public access sites throughout the state to provide boater education on exotic plants. The program goal is to teach boaters how to conduct a boat, motor and trailer inspection for hitchhiking plants. Hopefully, an equipment inspection for plants will become as routine as checking your boat to make sure the plug is in place. The Lake Host Program has been successful in stopping the spread of new exotic plant infestations at approximately ten lakes. We hope that you can convince your lake association to get involved with each of these important programs.

This is the first year that DES will be awarding research grants to institutes of higher learning. New Hampshire is currently the only state that is studying variable milfoil and it appears that we are also the state that is hardest hit by this exotic. The combination of research grants and an award of $1 million to study new management methodologies, milfoil physiology and genetics will help us battle the spread of invasive aquatic plants throughout the state.

As many of you know, VLAP was hit hard this winter when your coordinator was laid off. It was certainly tough times for the Biology Section as we had to reorganize people and program elements. Thanks to Andy Chapman and Alicia Carlson, all the annual reports have been written and are being sent out to you on a weekly basis. By the time you receive this newsletter, you should have received your report. The best news yet is that your VLAP coordinator is back on the job. Commissioner Nolin has a key interest in all of our lake programs and has worked hard to locate federal funds to reinstate Andrea as the VLAP Coordinator. Andrea began her second tour of duty on March 29 and will continue to provide volunteers with strong leadership to strengthen VLAP and maintain the program as one of the best volunteer programs in the country.

What to Expect This Year

Each year I try to give you some indication of what the lake quality will be in New Hampshire lakes based upon the proceeding winter and spring weather patterns. Weather patterns and lake quality are strongly related to one another. So how did I do last summer? I predicted a later but heavier Spring Diatom Increase resulting in greater turbidity and lower clarity in May and June. Also I noted more green and golden brown algal populations for July with some lakes experiencing cyanobacteria blooms in late August and September. Sound familiar to some lakes?

The 2003-04 winter season was very harsh with record low temperatures but with little snow cover. The lack of snow allowed greater sunlight penetration into the lake through the ice. The spring has been very wet and we have documented high runoff and high energy flow, from all our watersheds. I anticipate early growth of aquatic

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Freshwater Mussels in New Hampshire: Hidden Treasures of our Lakes

by Jill Ramsier, DES VLAP Intern (2002 - 2003)

Countless species of aquatic organisms live their lives in the lakes, ponds, and streams of New Hampshire. Most dwell along the shorelines or swim in the deeper waters, contributing to the complex aquatic web of life. One organism, however, lives its life burrowed in the bottom sediment, almost motionless and unnoticed. This organism is the freshwater mussel, a species that has been on Earth for at least 240 million years and plays a critical role in the health of freshwater ecosystems.

What are Freshwater Mussels?
Freshwater mussels belong to the mollusk family, and North America is home to more species of mussels than any other place on Earth. New Hampshire alone houses at least ten species of freshwater mussels. On average, mussels live between ten and 15 years. Mussels spend most of their lives as relatively stationary filter feeders and are usually found attached to substrates or burrowed beneath the sand in cool, shallow, or moving waters. They continuously filter water through fine gills to obtain bacteria, protozoans, and other organic particles for food.

The reproductive cycle of the mussel is one of the most interesting events in the freshwater ecosystem. Using a unique symbiotic relationship with certain fish species, mussel larvae attach themselves to a fish host, where they develop into juvenile mussels and eventually drop off the host. They then sink to the bottom of the water and begin to develop into full-grown mussels. This relationship has no significant negative effect on the fish host, but is critical for the survival of the young mussel.

Why are Mussels Important?
Throughout history, freshwater mussels have been used by humans as important components of tools and jewelry. Native Americans also used freshwater mussels as a supplemental food source. Although most species are edible, freshwater mussels are not as tasty as their saltwater relatives.

In addition, since they are long-lived filter feeders, pollutants can easily settle and build up inside mussels, making them distasteful and potentially unhealthy for human consumption. However, freshwater mussels are eagerly consumed by other members of the food chain, including raccoons, otters, and aquatic birds. Mussels also

A Freshwater Mussel.

serve the aquatic ecosystem by filtering particulate matter out of water, making the aquatic environment more suitable for other freshwater life.

One of the most important attributes freshwater mussels bring to our lakes, ponds and streams is that they are especially susceptible to many pollutants and contaminants. This means that the presence of mussels in our freshwater bodies can potentially indicate healthy water quality. It also means that the decline of an existing mussel population could indicate a water quality problem. In fact, mussels can indicate a water quality issue long before even the most sophisticated scientific equipment can detect a problem! For these reasons, mussels are an excellent indicator species.

A Threatened Resource
It is estimated that 70 percent of all freshwater mussel species

Freshwater Mussles cont'd on page 7

Attend the Annual Volunteer Lake Assessment Program Workshop!

The 2004 VLAP Annual Refresher Workshop will be held on Saturday, May 22 at DES in Concord. We strongly encourage that at least one monitor from each monitoring group attend the workshop. Workshop participants will learn about the latest legislative and program updates, the DES Watershed Approach, aquatic plant identification, and principles of lake ecology and sampling.

If you have not yet received information about this workshop and would like to attend, please contact Andrea LaMoreaux, VLAP Coordinator, at (603) 271-2658 or at alamoreaux@des.state.nh.us.

Exotic Aquatic Plants 2003 Update

by Amy Smagula, DES Exotic Species Program Coordinator

Last summer seems like long ago at this point, but here are a few updates from the summer of 2003 with regard to exotic aquatic plants.

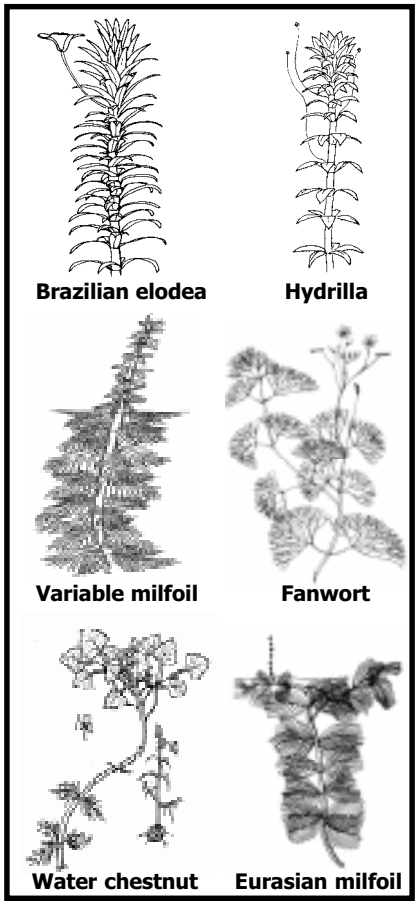
1. One new infestation of variable milfoil was found in a previously uninfested lake in Francestown. Scobie Pond (Haunted Lake) was added to the list of milfoil infested lakes and ponds in New Hampshire. Fifty-three waterbodies now have variable milfoil.

Fanwort was documented in a seventh site in the state. Manchester Water Works reported the possible presence of fanwort near Claire's Landing on Lake Massabesic in Auburn. DES biologists confirmed the presence of this plant in the lake in August 2003. Lake Massabesic was previously infested with variable milfoil, so this is not a new lake to add to our list of infested waters, but this is notable as fanwort has not been spreading for several years in New Hampshire.

Hydrilla verticillata, an exotic aquatic plant that state biologists believe will outcompete milfoil, was found 15 miles over the New Hampshire-Maine border in 2002. In 2003, an herbicide application was conducted in Pickerel Pond in Limerick, Maine, to control growths of this exotic aquatic plant. Maine biologists will continue to monitor the lake, but with this plant only 15 miles away, New Hampshire lake residents and users should play it safe and inspect their boats and trailers at public access sites and also conduct monthly Weed Watcher activities in their lakes and pond. This plant has not yet been found in New Hampshire.

One of the few infestations of Eurasian water-milfoil that was previously deemed 'eradicated' was found to be growing again. Eurasian milfoil was documented in Mountain Pond, Brookfield in the early 1990s. Biologists breached a beaver dam and drained the pond for three consecutive years in an effort to eradicate the invasive plant. After three years, the pond was filled when a new concrete dam structure was built. After a few years of monitoring with no sign of Eurasian milfoil, the project was thought to be successful. In 2003, DES biologists again visited the site for another follow-up inspection, and found five-foot tall Eurasian milfoil plants growing in the pond. It is thought that both male and female plants were present before the drawdown, and that seeds from the plants remained viable even during drawdown conditions.

One point of good news amidst this long list of not-so-good news is that the spread of variable milfoil seems to have slowed in recent years. Typically, variable milfoil spread at a rate of three or four new lakes each year. Now, it is more common to discover only one or two new infestations each year. We credit this reduction to extensive outreach and education efforts by DES, Fish and Game, New Hampshire Lakes Association, and the various lake associations participating in the Lake Host Program.



Exotic species of concern for New Hampshire.

The DES Exotic Species website was updated several times. Please visit our website at www.des.state.nh.us/wmb/exoticspecies for more information about what you can do to help prevent the spread of exotic aquatic plants.

ATTENTION VOLUNTEER MONITORS

Have you scheduled your annual DES biologist visit yet?

If not, we still have some dates available, but they are going fast! Please contact Andrea LaMoreaux, VLAP Coordiantor, at (603) 271-2658 or at alamoreaux@des.state.nh.us.

Your Public Beaches

by Sara Sumner, DES Beach Program Coordinator

New Hampshire's lakes and ponds offer something for everyone. They are a seasonal getaway, a limnologist's dream, and a recreational arena for many. On those hot days, a dip at the local public beach is a refreshing break from the summer heat.

The DES Beach Program monitors public beaches to ensure they are safe for swimming.

The DES Beach Program monitors 157 freshwater public beaches from mid-June through Labor Day. Fifty-two of those are located on VLAP lakes. Refer to the Beach Program's website for a complete list of VLAP lakes and beaches monitored at www.des.nh.gov/Beaches, click on "VLAP Lakes and Beaches".

2003 Update

The Beach Program began its 2003 sampling season on June 24.

Twenty-one beach advisories were issued at 16 freshwater beaches for bacteria violations. Four beach advisories were posted at freshwater beaches for toxic cyanobacteria scums. Seven VLAP lakes were affected by beach advisories.

Beach advisories may indicate that sources of bacteria or nutrients may be prevalent in the area. Remember, there are many ways you can keep your beaches bacteria and cyanobacteria free.

1. Make sure sanitary facilities are present and in working order. *Have you ever wondered where people go to the bathroom if there are no facilities present?*

2. Don't allow diapered children in the water!

3. Don't feed ducks, geese, or other waterfowl! *Feeding waterfowl attracts them to the area where they may defecate up to 28 times per day!*

4. Pick up after your dog. *You wouldn't want a child to find dog waste while playing in the sand!*

5. Use phosphorus-free fertilizers and leave a generous buffer zone of vegetation between the house and the lake. *Limiting the amount of nutrients entering the lake will limit algal growth.*

6. Maintain your septic systems. *Proper care and maintenance should prevent malfunctions and ensure that bacteria and nutrients aren't entering the lake.*

7. Keep the beach litter free. *Litter is not only unsightly but can also be a health hazard.*

Adopt-a-Beach

The 2004 beach season is quickly approaching!

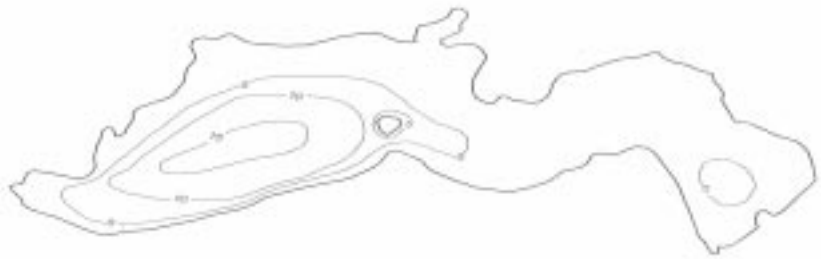
The Beach Program is looking for volunteers to adopt-a-beach. By initiating Adopt-a-Beach, DES hopes to reduce an increasing workload and expand the program to monitor new beaches. Utilizing volunteers will allow DES to focus efforts on problematic beaches, identify pollution sources, and reduce beach advisories.

Adopting a beach is a great way to ensure every effort is being made to protect public health and safety. Volunteers can perform beach inspections, which includes collecting bacteria samples, while conducting their routine VLAP monitoring. DES can also assist volunteers in organizing beach clean-ups and improvement projects.

If you are interested in adopting a beach and would like more information, contact Sara Sumner, at (603) 271-8803 or ssumner@ des.state.nh.us; or Alicia Carlson, at (603) 271-0698 or acarlson@ des.state.nh.us; or visit www. des.nh.gov/beaches.

Mussel Beach

by Ken Warren, DES Biologist



Bathymetric map of Shellcamp Pond, Gilmanton.

Imagine walking your dog down to the lake for a swim on a beautiful summer day only to discover wave after wave of dead, decaying, odiferous freshwater mussels washing up on the beach! Not a pretty image unless you happen to be a muskrat or raccoon with a big appetite!

This mysterious incident happened at Shellcamp Pond in Gilmanton during the Summer of 2003, much to the dismay of the pond residents.

What is causing the mussels to die? Is there something wrong with the water? What is the State going to do about this? These were some of the questions DES biologists were faced with from upset residents.

DES quickly responded by conducting several water tests, which all revealed normal water quality conditions. The New Hampshire Fish and Game Department and the United States Fish and Wildlife Service were consulted for possible answers. There were no explanations that seemed to fit the situation at Shellcamp Pond.

Further DES investigations revealed that common aquatic snails were also victims but the resident fish community was not. In addition, a local resident told DES investigators that the water level of the pond was lowered considerably for aquatic weed control purposes during the previous fall and early winter.

DES discovered that the drawdown for weed control had emptied approximately one-half of the water volume of the pond. As a result, DES concluded that the slow-moving mussels and snails had burrowed into the exposed lakebed when the lake was lowered. These mussels and snails were subjected to freezing temperatures during the early winter, which eventually caused them to perish. The water level of the pond was brought back to normal in late December and DES believes that the mummified mussels remained in the mud until the summer. In late June, water temperatures rose quickly, which likely caused the mussel tissue to decay and produce gas. The trapped gas in the shell created a "balloon effect" which caused the mussels to rise to the surface and wash up on shore in early July.

There is a happy ending to this story. DES divers later found several live mussels in the deeper part of the pond. It appears that only the mussels in the drawdown section of the pond were affected. DES biologists believe that the mussel population will rebound to normal levels in a few years. Everybody will be happy as a clam!

If your lake association is considering a drawdown to control aquatic weed growth, please contact DES for guidance. Water level drawdown can be an effective technique for at least the short-term control of aquatic weeds. However, this technique is species-specific and could possibly cause algal blooms, a reduction in the diversity and abundance of benthic invertebrates, and could affect the distribution of the fish population in the lake.

For more information contact Ken Warren at kwarren@des.state.nh.us or (603) 271-2964.

Lake Winona, New Hampton.

"Perhaps the truth depends on a walk around the lake."

Wallace Stevens

Freshwater Mussels
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in North America are listed as threatened or endangered, and at least two of the mussel species found in New Hampshire are on this list. Common threats to mussel populations include natural processes, such as predation, competition, floods and droughts.

However, humans increasingly affect mussel habitats through the introduction of pollutants into the aquatic environment from chemical spills, agricultural runoff, and industrial processes. In addition to these factors, native freshwater mussel populations can also decline due to the introduction of exotic species such as zebra mussels or Asian clams. Although neither of these exotics has been found in New Hampshire, they have no natural predators in the state and, if introduced, could easily out-compete native species.

What Can be Done?

1. Re-establish vegetation along lake and tributary shorelines to provide surface waters with a natural filtering system for potential sediments and pollutants.

2. In shallow lake waters, reduce heavy boating traffic, which can stir up the lake bottom and make water more turbid. These activities can help keep mussel gills clean and functioning.

3. Only use fertilizers and pesticides on shoreline lawns according to the provisions of the DES Shoreland Protection Act. This will help to reduce the chance of imposing pollutant build-up inside mussel bodies.

4.Considering a mussel's unique and delicate life cycle, protect their potential fish hosts. Keeping healthy plants and minimizing sedimentation of surface waters can ensure appropriate oxygen levels and suitable breeding grounds for fish.

5. To reduce the chance of unnatural predation from exotic species (such as zebra mussels or Asian clams), boats and recreational equipment should be washed both before and after use in a particular water body.

By implementing these steps, lake residents and recreationists can help to ensure that freshwater mussels remain a treasure of New Hampshire's freshwater ecosystems!

Limno Lingo

Need to brush up on your lake and pond terminology? Below you will find definitions of popular words that are often used when discussing lakes and ponds. These words have also been included in articles found in this newsletter.

Bathymetry: The measurement of water depth at various places in a body of water.

Lentic: Referring to standing waters, as in ponds and lakes.

Limnology: The scientific study of the life and phenomena of freshwater, especially lakes and ponds

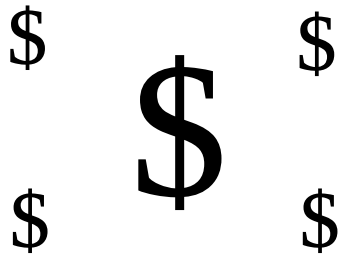
Lotic: Referring to running waters, as in streams and rivers.

Thermal stratification: Process by which deeper lakes become layered in the summer months, with warmer water at the surface and colder water sinking to the bottom.

Trophic classification: Biologically ranking the quality of lakes using a model that incorporates several parameters. In New Hampshire these parameters are: chlorophyll-a, Secchi disk transparency, aquatic plant abundance, and dissolved oxygen.

What's Our Water Worth?

Measuring the economic value of New Hamsphire's lakes, river, streams, and ponds



A recently released study of just five uses of the lakes, rivers, streams and ponds in New Hampshire reports that they annually contribute an estimated $247 million in property taxes and up to $1.5 billion in total sales to the state's economy.

Boating: $328 - $450 million
Fishing: $245 - $352 million
Swimming: $269 - $380 million
Drinking Water: $276 - $301 million

Many organizations, state agencies, and foundations contributed to the study. For more information, contact Andrea LaMoreaux at (603) 271-2658.

The Non Point Source Program: VLAP Lake Involvement

by Andy Chapman, DES Biology Section Watershed Protection Specialist

The New Hampshire Department of Environmental Services administers the Non Point Source (NPS) Program to assist municipalities, regional planning agencies, non-profit organizations, and conservation districts to address watershed management issues. Several VLAP lakes were involved with NPS Program activities during 2003.

Pond near Dutile Shores Road, which discharges sediment-laden water to Lake Winnisquam.

Lake Todd, Newbury

In 2001, the Town of Newbury received a DES Local Watershed Initiative Grant (LWIG) to fund an engineering design to manage stormwater runoff from Gillingham Drive. The Town submitted a design in the fall of 2002 as well as an additional application for a LWIG to implement the project. Best management practices (BMPs) to reduce sediment loading to the lake were implemented along the north section of Gillingham Drive in 2003.

Lake Winnisquam

Ahern State Park, Laconia

In December 2002, DES personnel met with the City of Laconia and the Ahern State Park Advisory Committee to discuss the water quality of Ahern State Park Beach. As a result of that meeting, DES developed and carried out a water quality monitoring plan for Ahern State Park at the beach area and within the Governor Park Stream watershed in the summer of 2003 (the stream discharges at the beach). The purpose of the monitoring was to identify sources of *E. coli* bacteria to the beach area.

During the summer of 2003, DES conducted a sanitary survey of the Governor Park Stream watershed along with multiple rounds of dry weather and wet weather sampling. Potential bacteria sources were identified, documented and mapped.

Hueber Drive, Belmont

Located adjacent to the railroad tracks north of Dutile Shores Road is a pond that directly discharges to Lake Winnisquam. Due to watershed runoff within the Huber Drive Brook subwatershed, sediment is transported through the pond and is discharged into the lake.

Although the sediment is being generated from numerous sources, the New Hampshire Department of Transportation (DOT) agreed to work with DES to find a solution to the water quality degradation. During the summer of 2003, DES met with representatives of DOT to discuss potential design solutions. DOT is in the process of designing a stormwater treatment area near Hueber Drive. The design will be incorporated into the second phase of the Route 3 reconstruction in Belmont.

Webster Lake, Franklin

Route 11 Realignment

In March 2003, DES met with DOT personnel to discuss stormwater treatment from the Route 11 realignment along Webster Lake in Franklin. DOT is considering design and installation of a level spreader and one or more infiltration devices, which would reduce sedimentation and other roadway and vehicle pollutants discharged to Webster Lake and its outlet.

Sucker Brook Watershed

On November 12, 2003, DES met with the health officers of the towns of Franklin and Andover. The purpose of the meeting was to discuss elevated *E. coli* levels in Sucker Brook, which extends from the outlet of Highland Lake in Andover and discharges on the west side of Webster Lake in Franklin. The meeting resulted in DES being designated the lead agency for investigation and both towns agreed to provide volunteer support during stormwater sample collection. DES has conducted an initial subwatershed investigation and anticipates mapping, survey work, and sampling will begin during the spring of 2004.

For more information about the Non Point Source Program, contact Andy Chapman at (603) 271-5334 or achapman@des.state.nh.us.

Lake Assoc. Steps up to the Plate cont'd from page 1

The students are loaded onto the pontoon boats with at least two DES biologists. The pontoon boats team up and head out to the lake. Each biologist is assigned to two or three pontoon boats. The boats tie together so the biologists have easy access to all of the students.

The biologists demonstrate sounding the bottom, conducting an oxygen and temperature profile, collecting water samples, conducting a plankton haul, and measuring water clarity. Since the purpose of the field trip is to give the students a hands-on experience with water sampling equipment, the biologists reach as many students as possible. Biologists also ask students to look at the watershed and identify pollution sources to the lake.

The Rindge students participate in an additional activity. They are broken into two groups before they arrive at the lake. As one group does the on-lake activity, the second group stays at the private beach to conduct a survey of the plants and animals along the shoreline. Once all of the Rindge students have conducted both activities, they get together and classify the lake to its trophic category. This is an activity that is suggested in the ILE curriculum.

DES believes that educating young students about lakes is vital to the continued protection of this valuable natural resource. There are many future limnologists out there whose interests need to be sparked! These students may also be volunteer monitors in training. But, our resources at DES are limited; we need your assistance to spread the word.

Do You Want to Try This?

If this sounds like an activity your association wants to try with local schools, John has the following words of advice:

1. Contact the school to determine if the teachers are interested.

2. Identify early how many students will be involved. You will need to place an order for the ILE workbooks well ahead of time.

3. Determine the activities and necessary participants. (Do you want to enlist the help of DES biologists? We are generally willing, as long as we're given ample notice. Or, you may feel comfortable demonstrating equipment to the students.)

4. If you are taking kids on the lake, make sure you have enough boats and, most importantly, life jackets!

5. The MLPOA covers the insurance for the excursions. If you would like to speak with John about how this has been done, let us know and we'll get you in contact with him.

Maybe you only want to provide the local school with the workbooks. If this is the route you take, consider scheduling a visit with the classroom to teach the students about your lake.

John believes all the work to organize this event is worthwhile. The students really enjoy the day on the lake. They are well prepared before the field trip and are quite knowledgeable about lake ecology issues. Their enthusiasm is contagious!

And, if you're interested in seeing just exactly how the Lake Monomonac residents do it, you are more than welcome to visit the next field trip! It is scheduled for June 9. Call Alicia Carlson at (603) 271-0698 for details. To learn more about the ILE curriculum, refer to the information following this article.

DES congratulates John Sarasin and his many volunteers for the terrific field trips they have organized over the years. We are always amazed by how much the students learn in such a short period!

More About the Interactive Lake Ecology Curriculum

The Interactive Lake Ecology student and teachers' workbooks are available for purchase!

The curriculum includes chapters on lake formation, water properties, the water cycle, the aquatic food chain, watersheds, pollution, non-native species, lake testing and classification. In addition, vocabulary exercises, experiments, and activities are included.

The student workbook costs $5.50, while the teachers' reference is $7.50. For information, contact Alicia Carlson at (603) 271-0698, or check out the ILE website at www.des.nh.gov/wmb/ILE.

Lake or Pond - What is the Difference?

From a regulatory viewpoint, there is no distinction between a lake and a pond in New Hampshire. Both are surface waters of the state and subject to the same water quality standards. From a naming convention, there is no precise difference between a lake and pond, although waterbodies named "lakes" are generally larger and/or deeper than waterbodies named "ponds." From an ecological or limnological perspective, there **is** a difference between the two. The difference, however, is somewhat arbitrary and not consistent or precise.

Regulatory

The water quality of the surface waters of the state, including all lakes and ponds, is regulated through statutes (RSA 485-A) and rules (Env-Ws 1700). These laws and regulations make no distinction between lakes and ponds. Both have to meet all the same water quality standards.

Naming

The term "lake" or "pond" as part of a waterbody name is arbitrary and not based on any specific naming convention. In general, lakes tend to be larger and/or deeper than ponds, but numerous examples exist of "ponds" that are larger and deeper than "lakes." For example, Echo "Lake" in Conway is 14 acres in surface area with a maximum depth of 11 feet, while Island "Pond" in Derry is nearly 500 acres and 80 feet deep. Names for lakes and ponds generally originated from the early settlers living near them, and the use of the terms "lake" and "pond" was completely arbitrary. Many have changed names through the years, often changing from a pond to a lake with no change in size or depth. Often these changes in name were to make the area sound more attractive to perspective home buyers. Examples of ponds that are now called lakes include Mud Pond to Mirror Lake in Canaan, Mosquito Pond to Crystal Lake in Manchester and Dishwater Pond to Mirror Lake in Tuftonboro.

Limnology

In limnology (the study of inland waters), surface waters are divided into lotic (waters that flow in a continuous and definite direction) and lentic (waters that do not flow in a continuous and definite direction) environments. Waters within the lentic category gradually fill in over geologic time and the evolution is from lake to pond to wetland. This evolution is slow and gradual, and there is no precise definition of the transition from one to the next.

Early limnologists in the late 18th and early 19th centuries attempted to define the transition from a lake to a pond in various ways. Area, depth or both were an essential part of most definitions, but what area or what depth differed. Some used thermal stratification – a lake is a body of water that is deep enough to thermally stratify into two or three layers during the summer in temperate regions such as New Hampshire. Others used plant growth – a pond is shallow enough that sunlight can penetrate to the bottom and support rooted plant growth across its entire width. Some included all plant growth (including submerged plants) while others said a pond was shallow enough to support emergent or floating-leafed rooted plants throughout. Although we won't attempt to define the distinction between a pond and wetland here (it is an even less precise distinction), a pond with emergent plants throughout would frequently be considered a wetland (marsh) by many observers.

Island Pond, Stoddard.

Limnologists today recognize that nature can't be divided into precise, neat categories and accept the fact that there will never be a precise definition. However, they also recognize that "deep" lakes and ponds function differently than "shallow" lakes and ponds, and modern limnology texts often discuss the two separately. The generally accepted definition of a "shallow" lake or pond is that class of shallow standing water in which light penetrates to the bottom sediments to potentially support rooted plant growth throughout the waterbody. Lack of thermal stratification and the presence of muddy sediments are also common characteristics of this class of water. In contrast, a "deep" lake or pond has both a shallow shoreline area that may potentially support rooted plant growth and a deeper portion where sunlight does not penetrate to the bottom. These waterbodies frequently stratify into distinct thermal layers during the summer.

This article was originally published as a DES Biology Section Fact Sheet (WD-BB-49). To read other lake biology related fact sheets visit www.des.nh.gov/bb.htm.

Water Reflects a Century of Change in New England

News Release, U.S. Department of the Interior and U.S. Geological Survey (July 22, 2003)

Modern wastewater treatment, environmental protection laws, road de-icing salts, and the shift from an agricultural to an urban-based society have resulted in significant changes during the past hundred years in the water quality of three major rivers in New England, according to a report released by the U.S. Geological Survey. Some of these changes have improved water quality, while others have adversely affected it.

The study included the Connecticut, Merrimack, and Blackstone Rivers. Scientists found statistically significant trends for five measured indicators of water quality. Concentrations of chloride, total dissolved solids, and nitrate increased in all three rivers. Phosphorus decreased in all three rivers, and sulfate decreased in the Connecticut and Merrimack Rivers. The Blackstone River had the highest concentrations of all five indicators measured. Its basin is also the most urbanized and the smallest of the three.

"Most striking of the trends we observed is the relation between increased use of salts to de-ice roads during the winter and the concentration of chloride in rivers," said Keith Robinson, the study's lead scientist. "In the

Merrimack River, the mean-annual concentration of chloride increased 760 percent during the century. In the Blackstone and Connecticut Rivers, the increase was more modest but still significant at 186 percent and 344 percent respectively," said Robinson.

On a brighter note, modern wastewater treatment and environmental protection laws are also having an effect. In the beginning of the century, New England's rivers were among the most polluted in the U.S. as industrial and municipal waste was dumped untreated into the water. Outbreaks of typhoid fever and other infectious diseases resulted. Today, those diseases are generally non-existent and the rivers are cleaner thanks to new and improved wastewater treatment. The banning of phosphates in detergent and soaps has contributed to a decrease in phosphorus compounds in these rivers.

Reduction in pollutant releases to the atmosphere has also changed river-water quality. After the national Clean Air Act of 1970 was implemented, emissions of sulfur compounds to the air decreased. Sulfate in river water has been similarly reduced. The decrease in sulfur emissions to air is the result of the conversion of electric power plants that use sulfur-laden coal to cleaner burning fuels such as natural gas, oil, and nuclear energy.

"Certainly, this study shows that our life styles have an effect on the area's rivers," Robinson explained. "Using what we have learned from this study will help water resource managers and private citizens to understand what the future of New England's rivers might be. This study also shows the value of long-term river monitoring for determining how our society is influencing the quality of rivers."

The report, titled "Water-Quality Trends in New England Rivers During the 20th Century," USGS Water-Resources Investigations Report 03-4012, is available online at www.water.usgs.gov/pubs/wri/wrir03-4012. To order a copy call 1-888-ASK-USGS.

For questions regarding this article, please contact Debra Foster at (603) 226-7837 or Keith Robinson at (603) 226-7809.

The New Hamsphire Department of Environmental Services' Volunteer River Assessment Program

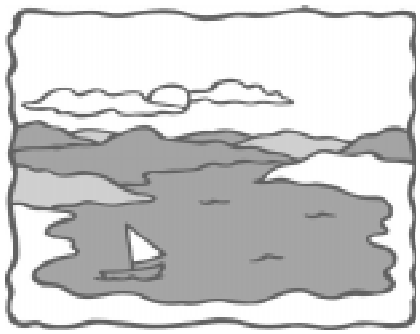
The Volunteer River Assessment Program (VRAP) was initiated in 1998 to promote education and awareness of the importance of maintaining water quality in New Hampshire's rivers and streams.

Today, over a dozen volunteer groups monitor rivers throughout the state and provide critical water quality data to DES to assist in assessing the ecological health of our rivers.

For more information about VRAP, visit the program website at www.des.nh.gov/wmb/vrap, or contact Ted Walsh, VRAP Coordinator at (603) 271-2083 or twalsh@des.state.nh.us.

Kids Korner

by Alicia Carlson, DES Environmentalist



Read the paragraphs below that explain lake formations.
Pay close attention to the vocabulary words in bold.
If you need help, ask an adult to help you.
Good luck and have fun!

Many thousands of years ago, glaciers moved across the North American landscape. As the glaciers retreated, they deposited piles of rocks and other materials, called **moraines**. A moraine can dam a river or stream to form a lake. Glaciers also deposited piles of ice, sand, and gravel that caved in after a period of time. The resulting hole in the ground would fill in with water, thus forming a **kettle lake**. Many lakes in New Hampshire were formed by glaciers.

Rivers can also create lakes. As a river meanders across the land, the movement of the water erodes one side of a stream bank and deposits the eroded materials on the other stream bank. Eventually, a river will become straight in the section where this erosion and deposition occurred. The original meandering section of the river remains, but it is no longer connected to the river. It is now its own smaller waterbody called an **oxbow lake**. These lakes are distinguishable by their horseshoe shapes. Is there a "Horeseshoe Pond" in your area?

In some areas of the world, lakes are formed when underground rocks are dissolved by acidic groundwater. Limestone and salty rock deposits are the most likely to be affected by this process. After the rocks dissolve, a depression is formed in the land that fills with water, and is called a **solution lake**.

Shifting of **tectonic** basins can also create lakes, including some of the deepest lakes in the world. Even volcanoes can produce lakes. After an eruption, the crater of a volcano, called a **caldera,** may fill in with water.

And, finally, where nature has not made lakes, humans can build **dams** to supply water for industrial uses, residential uses, and as a source of power. Humans have built many dams along rivers to create large, man-made lakes for the use of surrounding communities.

Unscramble the following words. Place the letters from the numbered spaces into the corresponding numbered spaces at the bottom of the page. The letters will form a phrase!

NUKSOLTEIALO	_ _ _ _ _ _ _ _ _ _ _ _
	11 2
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	1 7
ELATLEKTEK	_ _ _ _ _ _ _ _ _ _
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KOBEWXALO	_ _ _ _ _ _ _ _ _
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ASMD	_ _ _ _
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_ _ _ _ _ _ _ _ _ _ _ _!

1 2 3 4 5 6 7 8 9 10 11 12

SOLUTION: *On page 14*

Milfoil Beware: You're Now the Target of More Intensified Scrutiny!

by Amy Smagula, DES Exotic Species Program Coordinator

Aaah...spring is here. Can you believe that even under the shroud of snow and ice we had this winter that milfoil was plotting its tactics for the upcoming growing season? Where will it infest this year? Will it branch into the next cove of this or that lake? Will it be able to get past the ever more watchful eyes of state biologists, Weed Watchers, and Lake Hosts?

Well, New Hampshire has a message for the milfoil, and it's "Look Out!" Thanks to the efforts of Senator Judd Gregg, New Hampshire will be the recipient of federal funds to conduct in-depth technical research into various aspects of variable milfoil, including the ecology, biology, genetics, chemistry, economics, and control associated with this obnoxious invasive plant.

In March 2004, a request for conceptual proposals was sent out to academia, research consultants, and other qualified parties to identify research activities to battle milfoil on all fronts. Research on the ecology and biology of milfoil will be aimed at learning more about the invasive nature of this plant and what it needs to thrive. Chemistry related projects will examine the water and substrate chemistry of milfoil infested lakes to determine impacts to habitat and if there are specific chemical characteristics that stand out in infested and uninfested lakes. Economic evaluations will tell us how much of an impact this nuisance plant is really having on the local and state economy. Control research will be aimed at establishing longer term mechanisms for managing milfoil in our lakes and ponds that are already infested.

Milfoil attached to a boat and trailer.

DES reviewed the conceptual proposals in April and plans to work with the selected candidates to formulate final comprehensive plans for research that will begin in the fall of 2004.

So, milfoil, your years of wreaking havoc on our lakes are numbered! We have you in our sights, and you're going down!

Lake Trivia: Stump Your Fellow Lake Enthusiasts!

Famous Lakes of the World

Q: What is the deepest lake in the United States?

A: Crater Lake, Oregon
At 1,943 feet (592 meters), Crater Lake in Oregon is the deepest lake in the United States and seventh deepest in the world. The lake was formed when an ancient volcano, Mt. Mazama, collapsed back into itself after a shattering eruption. Mt. Mazama built up to a height of 12,000 feet through many eruptions over the past half a million years. One last eruption 7,000 years ago blasted out so much of the magma collected beneath it that the suddenly hollow Mt. Mazama sank into the gap and disappeared.

Q: What is the deepest lake in the world?

A: Lake Baikal, Siberia
It measures 5,315 feet (1,620 meters) deep. Situated in south-east Siberia, the 12,162 square mile (7,783,819 acres) Lake Baikal is the oldest (25 million years) and deepest lake in the world. It contains 20 percent of the world's total unfrozen freshwater reserve. Known as the 'Galapagos of Russia', its age and isolation have produced one of the world's richest and most unusual freshwater faunas, which is of exceptional value to evolutionary science.

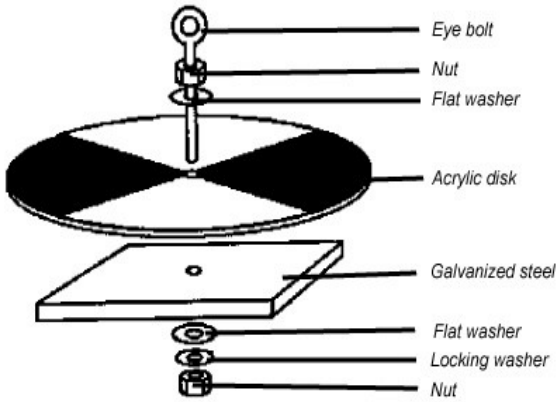
Q: What freshwater lake covers the most surface area in the world?

A: Lake Superior, Great Lakes
Lake Superior covers 31,700 square miles (20,304,649 acres), an area equal to Massachusetts, Connecticut, Rhode Island, Vermont and New Hampshire combined. If you were to kayak its shoreline and islands, you would travel 2,726 miles (4,389 kilometers). In addition, it holds 10 percent of the world's freshwater.

Sampling Tip: How To Make Your Own Secchi Disk

Materials:

- 20-cm diameter circle of acrylic disk $^{3}/_{8}$" or $^{1}/_{2}$" in thickness (aluminum or steel may be substituted, but wood is not recommended)
- 15-cm circle or square of $^{1}/_{8}$" galvanized steel (used to weight the disk)
- hand drill
- eye bolt – $^{5}/_{16}$" x 2"
- two flat $^{5}/_{16}$" washers
- one locking $^{5}/_{16}$" washer
- two $^{5}/_{16}$" nuts
- flat black rust resistant spray paint
- flat white rust resistant spray paint
- masking tape
- calibrated brass chain or nylon rope ***** (Cut long enough to be the depth of your lake's deep spot.)



Instructions:

1. Divide the 20-cm acrylic disk into quadrants using masking tape.

2. Spray paint alternating quadrants black and white, so that you have a disk that is similar to that pictured above. Let the paint dry. Apply a second coat of paint if necessary.

3. Drill a $^{3}/_{8}$" hole through the center of the acrylic disk and the galvanized steel disk.

4. Assemble disks with eyebolt ($^{5}/_{16}$" in diameter). Use flat washers between disk and nut, and between steel plate and locking washer. Use $^{5}/_{16}$" nuts at the top of the eyebolt and to bolt the steel plate on the underside of the acrylic disk.

5. Attach a brass chain or rope calibrated by 0.5 meter increments to the Secchi-disk to use in the lake.

***** If rope is used, avoid using cotton rope or clothesline since it stretches when it is wet. Use non-stretching white plastic coated wire-core clothesline. Make sure to bend and straighten the line before you buy it to make sure that it will lie straight. Calibrate the rope at 0.5 meter increments using permanent pen, or by tying knots at each 0.5 meter interval.)

KID'S KORNER SOLUTION: *LAKES ARE COOL!*

Participate in the 2004 Great North American Secchi Dip-In!

The 2004 Great North American Secchi Dip-In will be held between June 26 and July 11. This year marks the tenth anniversary of the Dip-In.

Please help us let the nation and the world know how clear New Hampshire's lakes and ponds are by participating in the 2004 Dip-In! Call now to reserve your Secchi disk!

Using a Secchi Disk to measure lake transparency at the deep spot.

For more information about the Dip-In, or to reserve a Secchi-Disk, please contact:

Jody Connor
DES Limnology Center Director
(603) 271-3414
jconnor@des.state.nh.us

Andrea LaMoreaux
DES VLAP Coordinator
(603) 271-2658
alamoreaux@des.state.nh.us

Connor's Corner
continued from page 2

plants this spring. Those lakes with milfoil infestations will have lush green plants growing by the time you receive the newsletter. Milfoil plants may flower earlier this year.

Already this spring, the vast amount of runoff has brought an increased phosphorus load to the lakes. With a fairly early ice out, quickly warming waters and a fresh supply of phosphorus, look for another early appearance of the Spring Diatom Increase. Anticipate turbid, low clarity waters from May through June before the lakes become clearer in July. If we have ample summer sunlight, look for more filamentous green algae in the near shore littoral zones. The appearance of cyanobacteria blooms in lakes are difficult to predict, but if you had these blooms last year, be on the lookout for the appearance of blue-green water or what may look like tiny paint chips in the water. You should also observe the yellow appearance of the lake in June. This is a result of the annual pine pollen release that clouds the water resulting in lower lake clarity.

The thicker ice conditions in shallower lakes this past winter has already taken a toll on some fish. Although the higher lake levels last fall will lead to less competition for spawning grounds for fish, a warm spring will increase littoral water temperatures. This means a mixed bag for the fish population since the higher spring water levels may be good but the warmer temperatures will increase the stress level for spawning. Look again for moderate fish kills during late May to mid-June.

In closing...
Don't forget, if you catch a fish and want to donate it to the mercury-in-fish program, we continue to provide the opportunity to submit fish for mercury analyses. If you have yet to submit a fish or would like to submit more fish, give us a call and we will let you know the correct procedure for handing and submitting fish. Remember, New Hampshire continues to have a fish advisory for mercury that limits the amount and species that one can consume.

Andrea and I hope that you all have a safe and successful sampling year. Always remember to have fun and enjoy your sampling days out on the lake. Remember to call upon us if you need anything! We hope to see you all on May 22 at our annual VLAP Workshop.

Small Outreach and Education Grant Programs Available for Nonpoint Source Pollution

This program provides small grants of $200 to $2,000 for outreach and education projects relating to nonpoint source pollution (NPS) issues that target appropriate audiences with diverse NPS water quality related messages. These small grants are available year-round on an ongoing basis, which allows applicants to move forward with outreach and education projects without having to wait for annual application deadlines.

The DES Watershed Assistance Section will administer the grant program using $20,000 each year from the U.S. Environmental Protection Agency under Section 319 of the Clean Water Act.

For More Information:

Barbara McMillan
Watershed Assistance Section
NHDES, PO Box 95
Concord, NH 03302-0095
bmcmillan@des.state.nh.us
(603) 271-7889

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

Are you Interested in Purchasing your Own Set of Sampling Equipment?

DES will loan out all of the necessary sampling equipment and collection bottles to VLAP volunteer monitors upon advanced request. Typically, a volunteer monitor will need the following equipment to collect VLAP samples:

- Secchi Disk
- Kemmerer Bottle
- Messenger Weights
- Integrated Sampler
- Calibrated Chain

Using a Kemmerer Bottle to collect deep spot samples.

If you are interested in purchasing your own set of equipment, please contact Andrea LaMoreaux, VLAP Coordinator, at (603) 271-2658 or at alamoreaux@des.state.nh.us for more information.

Please note that it may be difficult to purchase an Integrated Sampler specifically for your lake or pond, but it is easy to make one! Please contact DES for instructions.

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